Nichols, H.E.

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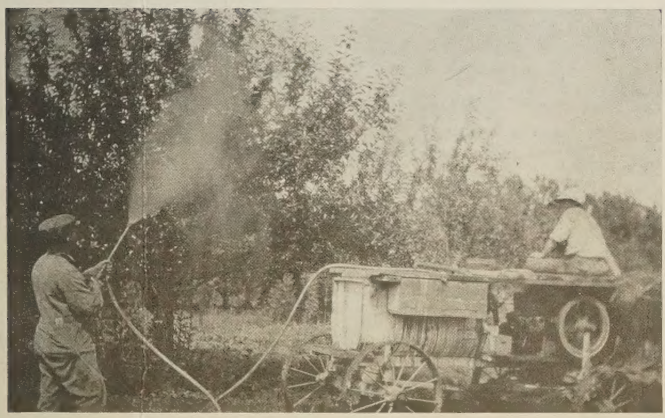
SPRAYING IOWA ORCHARDS



Type of power sprayer used in many spray rings. Hundreds of Iowa farm orchards are sprayed with small power sprayers such as this.

IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

EXTENSION SERVICE
R. K. Bliss, Director

AMES, IOWA

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SPRAY SCHEDULE FOR APPLES AND PEARS

Fig. 1. Correct time for applying Cluster Bud Spray. Note blossom buds are separated.

Fig. 2. Petals have just dropped. Right time for Calyx Spray.

1. CLUSTER BUD SPRAY*

TIME

Apply as the blossom buds separate and before they open.

MATERIALS

Use 5 to 6 quarts of liquid lime sulfur (or 4 pounds of the dry form), plus 1½ pounds of lead arsenate with water to make 50 gallons of mixture.

PURPOSE

To control apple scab, bud moth, canker, worm curculio, etc.

2. CALYX SPRAY

TIME

Apply as soon as 95 per cent of the petals have fallen and before the calyx of the young fruit grows shut.

MATERIALS

Use 5 quarts of liquid lime sulfur (or 3½ pounds of the dry form), plus 1½ pounds of lead arsenate with water to make 50 gallons of mixture.

PURPOSE

To control apple scab, first brood codling moth, canker worm, green fruit worm, etc.

*By adding ½ pint of nicotine sulfate to this spray, the plant lice (aphids) often found on the opening apple buds, may be controlled. Most of the [illegible] found on the opening buds of apple trees in Iowa belong to the species commonly known as the grain aphis (aphis avenae). These only live on the apple a short time and then migrate to other plants, so it seems doubtful whether it pays to try to control them, even tho they do cause some damage. It is quite important, however, where aphids are found later in the summer on cherry, plum and young apple trees, to control them by spraying with nicotine sulfate.

SPRAY SCHEDULE FOR APPLES AND PEARS

Fig. 3. Shows size of fruit at time of applying First Cover Spray.

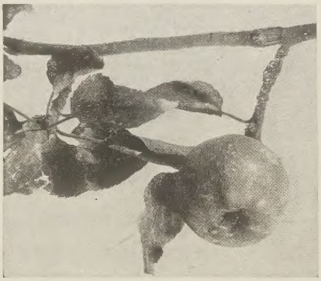

Fig. 4. Fruit is about this size when Fourth and Fifth Sprays need to be applied.

3. FIRST COVER SPRAY 4TH AND 5TH SPRAYS**

TIME

3. First Cover Spray
Should be applied 10 to 14 days after the calyx spray.

4th and 5th Sprays**

Fourth Spray: Apply July 20 to 30 in Southern Iowa, July 25 to August 5 in northern Iowa.

Fifth Spray: Apply two to three weeks after fourth spray.

MATERIALS

Either 4½ to 5 quarts of liquid lime sulfur (or 3 pounds of dry), or 3-3-50 bordeaux mixture, plus 1 pound of lead arsenate with water to make 50 gallons of mixture.

Either 4 quarts of liquid lime sulfur (about 3 pounds of dry), or 3-3-50 bordeaux mixture, plus 1 pound of lead arsenate with water to make 50 gallons of mixture.

PURPOSE

To control first brood codling moth, scab and apple blotch.

To control second brood codling moth, scab and sooty blotch.

**Two sprays to control the second brood of the codling moth are recommended for Iowa conditions for the first time in this spray leaflet. During the past few years ineffective control with one late spray has been noticed in many orchards. Some growers have applied the later spray and have secured almost perfect control. The fifth spray may be safely omitted only in orchards wherein the past four sprays have given complete control.

SPRAYING IOWA ORCHARDS

By H. E. Nichols

Efficient spraying practices are essential to profitable fruit production. In fact, spraying is usually considered the one orchard operation that pays the highest returns. The difference between success and failure in the orchard usually depends upon an efficient spraying program.

The bulk of the Iowa apple crop is produced in farm orchards. Perhaps half of these orchards are sprayed with varying degrees of success. Commercial growers are, as a rule, more thoro with their spraying, but many of them could profitably improve their methods.

SECURING RESULTS FROM SPRAYING

Failure to get good results from spraying is usually due to the fact that the grower failed to consider one or more of the following points: (1) Have some knowledge of the pests to be controlled. (2) Use an adequate spray machine and equipment. (3) Use the right spray materials. (4) Apply sprays with sufficient pressure. (5) Apply the necessary number of sprays. (6) Apply them at the right time. (7) Dilute them properly. (8) Thoroly cover the trees with the spray.

By following the directions here given good results will be obtained under most conditions. It must be remembered that the results to a certain extent, will vary with the season and with local conditions.

ADDITIONAL APPLE SPRAYS

The five sprays dealt with on pages 2 and 3 should be applied to all fall and winter apple trees in Iowa. Summer apples need only the first three. Under certain conditions, some of the following additional sprays may be necessary.

Fig. 5. *Scale insects*—left to right: San Jose Scale, Oystershell Scale and Scurfy Scale.

Dormant Spray. This spray, applied just before growth starts in the spring, is necessary where there are severe infestations of oyster shell or scurfy scale and where the San Jose scale is found. The first two scale insects named are more commonly found in northern Iowa, but are also bad in many places in the southern part of the state. The San Jose scale (by far the most destructive of the three) is mainly limited to certain counties in southeastern Iowa.

For control, use 6¼ gallons of liquid lime sulfur with enough water to make 50 gallons of mixture and thoroly cover the tree.

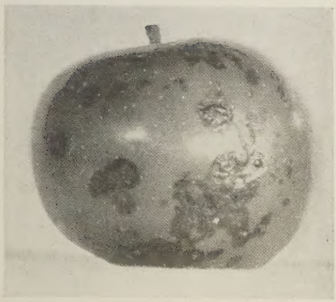

Fig. 6. *Apple Blotch.* Note bright black spots that are irregular in shape.

Apple Blotch Sprays. This disease is very bad in southern Iowa on such varieties as Northwestern Greening, Ben Davis and Missouri Pippin. Under Iowa conditions it can usually be controlled by applying two sprays, the first two weeks and the second four weeks after blossoming time. This means an extra spray is needed on susceptible varieties, two weeks after the regular first cover spray, using the same materials. Bordeaux mixture is usually favored over lime sulfur for blotch control.

Apple blotch affects the fruit, the twigs and the stem of the leaf. On badly infested trees many of the twigs and smaller branches will be covered with small cankers. These cankers give the twigs a rough appearance. Similar cankers, only smaller, will often be found on the stems of the leaves.

The disease lives over winter in the cankers on the twigs. In the spring these are soaked up by the seasonal rains. About two to three weeks after blossoming time, the spores of the fungus are discharged from the cankers and drop onto the newly formed fruit. Where a spore lodges on an apple it germinates and develops into one of the characteristic spots as shown in Fig. 6.

Apple Maggot or Railroad Worm. This insect, until recently, was confined to the northern fourth of the state. It is slowly spreading and has been reported recently in southern Iowa. Where damage from this insect has been noticed, apply a spray consisting of 1 pound of lead arsenate to 50 gallons of water, July 10 to 20, preceding the fourth spray by about two weeks. As an added precaution all drop apples should be gathered up and destroyed in the early fall. This can be done either by hand or by turning hogs into the orchard.

Fig. 7. *Apple Maggot.* Note how larva has tunneled all thru the fruit.

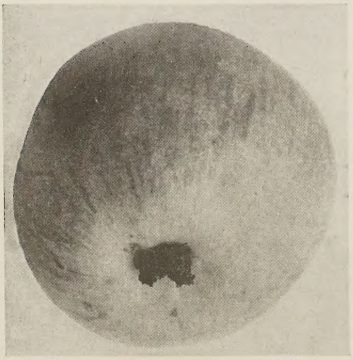

Fig. 8.

Codling Moth. Figure 8 shows the typical injury in the blossom end of the apple caused by the first brood of this insect. Some of the first brood worms and most of the second brood go in the side of the fruit. The first brood worms usually enter the fruit from two to three weeks after blossoming and the second brood start hatching out and entering the fruit in southern Iowa, July 20 to 25. They keep entering the fruit over a period of several weeks. This is the most serious pest the Iowa fruit grower has to fight. All the sprays except the cluster bud are mainly for controlling this insect.

Fig. 9.

Green Fruit Worm. This large soft, green worm (Fig. 9) does its damage soon after blossoming time. Where it eats into the core the fruit drops off. If only a small amount of the skin and flesh of the apple is eaten the fruit matures malformed in various ways so that the fruit at best can be classed as second grade. More usually they are culls. The second and third sprays easily control this worm.

Fig. 10.

Aphis or Plant Lice. The apple shoot in Fig. 10 is covered with aphis. There are three different kinds, all of them green in color, that injure the apple. Brown colored aphis are often found on plums and cherries. Many other kinds are commonly found on a wide variety of plants. To control this insect it is necessary to get the spray in contact with each aphis. As they usually curl the leaves and are found on the under side of them, it is necessary to spray before the leaves are badly curled.

Apple Scab. The apple in Fig. 11 shows the typical spots which this disease causes on the fruit. Smaller brown spots may also be found on the leaves. The fruit usually becomes infected at blossoming time and the disease will develop thruout the season, depending on the amount of rainfall. During seasons of heavy rainfall scab is quite serious. The cluster-bud spray is applied mainly to control scab. The later sprays also help hold it in check. Early infection usually malforms the fruit.

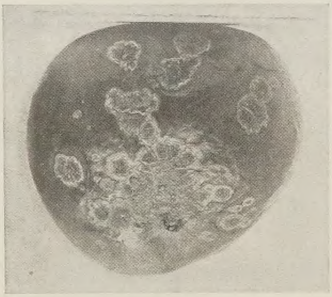

Fig. 11.

Sooty Blotch: This disease is variously known as sooty blotch, fly speck, or cloud. It develops late in the summer, after rains. It is only on the surface of the fruit and does not seriously affect its keeping qualities. It does, however, seriously affect the looks and selling qualities of the fruit. The late summer sprays easily hold it in check.

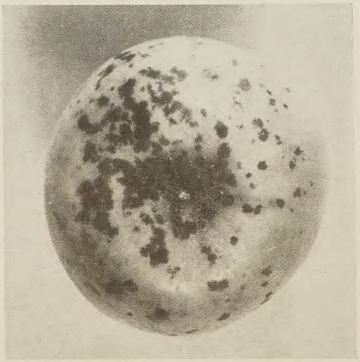

Fig. 12.

Cedar Rust. Figure 13 shows the typical yellowish spots of cedar apple rust on the leaves of the apple. To a more limited extent it will make similar spots on the blossom end of the fruit itself. This disease lives both on the apple and on the red cedar tree. On the latter it makes the so-called cedar apples. Wealthy and Jonathan are more subject to this disease than most other varieties in Iowa. Where red cedars are found near the orchard, this disease is usually present. It is difficult to control cedar rust effectively by spraying.

Fig. 13.

SPRAYING STONE FRUITS

In spraying the home orchard, cherries and plums are usually sprayed after blossoming time along with the apples. As both of these fruits blossom before the apple and are usually in full bloom at the time of the apple cluster bud spray, their cluster bud spray should be applied earlier.

Plums: Plums affected with plum pocket, (the fruit soon after blossoming time puffs up and later dries up and drops), should receive a dormant spray of 3 gallons of liquid lime sulfur to 50 gallons of mixture.

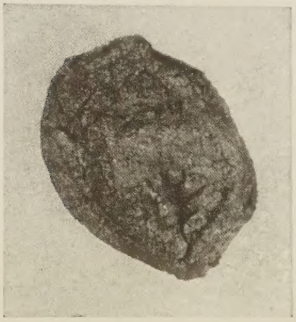

Fig. 14. *Brown Rot.* All such dried up plums should be gathered up and destroyed. Rots the plums as they reach maturity.

Brown rot, curculio and leaf spot are the most serious troubles of the plum. In order to obtain the best control of brown rot on plum, it is advisable to apply a spray at the time the flower clusters are separating. Spray just after the husks have fallen off the young fruit and again in about two weeks (same as the second and third sprays on apple.) Use the same materials as for apples. In wet seasons, additional sprays applied 10 to 14 days apart will be necessary to control brown rot.

Lime sulfur is liable to burn the foliage of Japanese plums and certain hybrids of the Japanese and the native sorts. Where such damage has been noticed, use dry-mix sulfur lime.

Cherries: Leaf spot, curculio and pear slug are the most common troubles affecting the cherry in Iowa. Except in very few cases, no spray is needed on the cherry until after blossoming. Apply one just after the husks drop off the newly formed fruit and again in 10 to 14 days as with the plum. Apply a spray just after the fruit is picked, consisting of 4 quarts of liquid lime sulfur or 3-3-50 bordeaux mixture, plus 1 pound of lead arsenate to 50 gallons of mixture. Bordeaux mixture is usually considered more effective in controlling leaf spot than lime sulfur.

Peaches: Brown rot, peach scab, curculio and leaf curl are the most destructive pests on peaches in Iowa.

Apply a dormant spray, just before growth starts, consisting of 3 gallons of liquid lime sulphur to 50 gallons of mixture for peach leaf curl.

To control the curculio, apply a spray of lead arsenate, 1 pound to 50 gallons of water, to which 2 pounds of lime have been added, just as the husks have been shed from the newly formed fruit.

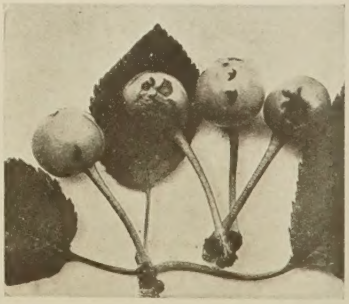

Fig. 15. *Curculio.* Egg laying punctures of plum curculio on cherry. Also attacks plums, peaches, and apples.

Usually two sprays will keep brown rot and scab under control, one applied about three weeks after blossoming and another about a month before the fruit ripens. Use dry mix sulfur lime and as a control for curculio, add 1 pound of lead arsenate to each 50 gallons. Never use lime sulfur or bordeaux mixture on peaches after the leaves have developed. Either will cause severe burning.

Fig. 16. *Cherry Leaf Spot.* Most common disease on cherry leaves. Where bad, it will defoliate the tree in mid-summer.

MIXING AND APPLYING SPRAYS

In preparing the common lime-sulfur-lead arsenate spray, first weigh out the required amount of lead arsenate and mix into a thin paste in a separate container. Empty this into the sprayer when it is about half full of water. When the tank is nearly full, add the required amount of liquid lime-sulfur. Stir **thoroly** and apply at once. Never save any of the mixture for a later spray. Always add the lime-sulfur last. Never mix the two materials in the concentrated form.

In the dormant, cluster bud and calyx sprays cover every part of the tree with the spray. In the later sprays cover every apple by spraying each part of the tree from two directions. Be **thoro.** More people fail in results from this cause than any other. It usually requires from 4 to 6 gallons of diluted spray material to effectively cover a 20 year old apple tree at one spray time, depending upon which spray is being applied, the spray outfit, pressure and size of opening in the spray nozzle.

Young fruit trees and non-bearing trees should be sprayed at the time of the cluster-bud and calyx sprays.

Spraying, to be effective, must be done at the right time. At each spray time there is usually 4 to 6 days when sprays can be effectively applied. Spraying too early or too late is a waste of time and materials.

SPRAY MATERIALS

Lead Arsenate: The standard poison for killing leaf and fruit eating insects. Other poisons such as paris green and calcium arsenate should not be used on fruit trees as they may cause burning of the foliage.

Nicotine Sulfate: The most practical material used to control sucking insects such as plant lice (aphids). It can be added to other spray mixtures or can be used alone. When used alone, add enough soap to make the water sudsy, (3 to 6 lbs. to 50 gal.) Nicotine sulfate is commonly used at the rate of 1 part to 800 parts of water, or ½ pint in 50 gallons.

Lime-Sulfur: Is more commonly used to control fungous diseases and scale insects than any other material. It is found on the market in two forms—liquid and dry. The liquid is the most economical form to use, and is usually considered more effective. Frequently, however, the dry form is more easily obtained and more convenient, especially for the man with just a few trees, and its use is reasonably satisfactory. It requires about 2½ to 3 pounds of the dry form to equal a gallon of the

liquid. Commercial liquid lime-sulfur usually tests 33 degrees Baume in density. All spray dilutions are based on this standard strength. With standing and especially freezing, it will often lose in strength. The only way to be sure of the strength is to test with a lime-sulfur hydrometer. Dry lime-sulfur will keep over winter if put in an air tight package.

Bordeaux Mixture:* Made of copper-sulfate, (blue vitriol) lump lime and water. The most common mixture is the 3-3-50 formula; that is, 3 pounds of copper sulfate, 3 pounds of lump (unslaked) lime, to 50 gallons of water. For some diseases bordeaux is more effective than lime-sulfur. It is, however, apt to russet the fruit if used in the cluster bud and more especially the calyx spray on apples. Lime-sulfur, on the other hand, is more liable to burn when the weather is hot. Hydrated lime may be substituted for lump lime, providing 50 per cent more by weight is used. (Never use air slaked lime.)

Dry Mix Sulfur Lime: This is a new spray material now used considerably in the east to control diseases on peaches. It is used on plants that are susceptible to burning by lime sulfur and bordeaux. It is made by mixing, dry, 8 pounds of finely ground sulfur, 4 pounds of hydrated lime and ½ pound of calcium caseinate. Mix these into a thin paste with a little water and then dilute to 50 gallons.

ESTIMATING AMOUNT OF SPRAY MATERIALS TO BUY

It is always best to order enough spray materials in the spring to last thru the one season only. There is too much danger from deterioration in some materials, if kept over winter altho they can be safely kept from one season to the next with correct storage conditions.

Fig. 17. A good type of barrel sprayer for use in farm orchards. The tower or platform aids materially in effectively spraying the tops of tall trees.

In ordering liquid lime-sulfur and lead arsenate for orchard spraying, buy 1 gallon of lime-sulfur and 1 pound of lead arsenate for every two trees 20 to 25 years old. This will be enough for four to five sprays during the season. If the trees are small, estimate the number of them that it will take to equal one 25 year old tree.

The dormant spray will require 0.6 gallons of concentrated liquid lime-sulfur in addition to the above for the average sized tree.

If bordeaux mixture is used it will require one-third pound each of copper sulfate and lump lime per tree per spray.

In buying nicotine sulfate order 1 pint for every 20 average sized trees that are to be sprayed.

*For detailed directions for making bordeaux mixture, write Horticultural Extension Service, Ames, Iowa.

DILUTION TABLE FOR SPRAY MATERIALS

Name of Material and Strength	Number of gallons of diluted spray material.					
	200	100	50	10	5	1
Liquid lime sulfur, 6¼ gal. in 50 gal. Dormant spray strength.	25 gal.*	12½ gal.	6¼ gal.	5 qts.	5 pints	1 pint
Liquid lime sulfur, 6 qts. in 50 gal. Cluster bud spray.	6 gal.	3 gal.	6 qts.	2½ pints	1¼ pints	¼ pint
Liquid lime sulfur, 5 qts. in 50 gal.	5 gal.	2½ gal.	5 qts.	1 quart	1 pint	1-5 pint
Liquid lime sulfur, 4 qts. in 50 gal.	4 gal.	2 gal.	4 qts.	1½ pints	¾ pint	1-6 pint
Dry lime sulfur, 4 lbs. in 50 gal.	16 lbs.	8 lbs.	4 lbs.	13 oz.	6 oz.	1¼ oz.
Dry lime sulfur, 3 lbs. in 50 gal.	12 lbs.	6 lbs.	3 lbs.	10 oz.	5 oz.	1 oz.
Lead arsenate, 1½ lbs. in 50 gal.	6 lbs.	3 lbs.	1½ lbs.	4½ oz.	2¼ oz.	2 table-spoonfuls
Lead arsenate, 1 lb. in 50 gal.	4 lbs.	2 lbs.	1 lb.	3¼ oz.	1½ oz.	1 table-spoonful
Bordeaux mixture, 3 lbs. copper sulfate, 3 lbs. lump lime, 50 gal. water.	12 lbs. 12 lbs. 200 gal.	6-6-100	3-3-50	10 oz. 10 oz. 10 gal.	5 oz. 5 oz. 5 gal.	1 oz. 1 oz. 1 gal.
Nicotine sulfate (40%), ½ pint to 50 gal. (1 to 800)	1 qt.	1 pt.	½ pt.	3 table-spoonfuls	1½ table-spoonfuls	1 tea-spoonful

*This figure, in each case, denotes the amount of concentrated spray material needed to make the amount of diluted spray designated at the top of each column.